

5 a back wall layer between the plurality of flexible shield layers and the protective cover;  
 6 and  
 7 fasteners attached to the protective cover and capable of releasably securing the flexible  
 8 shield layers to a structure to be protected.

1 38. A particle shield, comprising:  
 2 a plurality of flexible shield layers, each shield layer having a thickness that is  
 3 determined based on a size of a particle to be shocked;  
 4 a resilient support layer between adjacent ones of the flexible shield layers;  
 5 a protective cover configured to enclose the flexible shield layers;  
 6 a back wall layer between the plurality of flexible shield layers and the protective cover;  
 7 and  
 8 fasteners attached to the protective cover and capable of releasably securing the flexible  
 9 shield layers to a structure to be protected.

### REMARKS

Claims 1-32 were pending in this Application. The second instance of claims 30 and 31 and the last claim 32 have been renumbered by the Examiner as claims 32-34. Claims 35-38 have been added. Claims 23-26 have been cancelled. Hence, claims 1-22 and 27-38 are now pending in this Application.

Claim 16 has been amended to remove an alternative limitation. Support for the amendment may be found throughout the Specification in general, and at least on page 16.

Claim 17 has been amended to remove the indefiniteness noted by the Examiner. Support for the amendment may be found throughout the Specification in general, and at least on page 7.

Claim 27 has been amended to recite that the at least one flexible shield layer has an areal density that is substantially equal to a predetermined constant times a hypervelocity particle's cubic density multiplied by its diameter. Support for the amendment may be found throughout the Specification in general, and at least on page 14.

Claims 35-38 have been added. Support for these claims may be found throughout the Specification in general, and at least on pages 16, 10, and 12.

Marked-up changes to claims are attached herewith in Appendix A. A copy of the currently pending claims is included herewith in Appendix B. No new matter was added.

### **Restriction Requirement**

The Examiner raised an election/restriction requirement for the claims as follows:

Group I: Claims 1-22 and 27-34

Group II: Claims 23-26

Applicants hereby elect, without traverse, claims 1-22 and 27-34 directed to Group I for further prosecution in this Application. Claims 23-26 directed to Group II are withdrawn from further consideration in the Application. Applicants reserve the right to file the withdrawn claims in a subsequent divisional application.

### **Claim Rejections**

Claims 16 and 17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claims 1, 2, 7-11, 13, 14, 16-22, 27, 28, and 32-34 are rejected under 35 U.S.C. 102(e) as being anticipated by *Dvorak* (U.S. Patent No. 6,298,765); and claims 3-6, 12, 15, and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Dvorak*. These rejections are respectfully traversed.

### **The Claimed Invention**

The present invention, as recited in claim 1, is directed to a particle shield. The particle shield is comprised of a plurality of flexible shield layers adjacent to resilient support layers. A protective layer, with vents on a periphery thereof, encloses the flexible shield layers. A back wall serves as the last layer of protection within the protective cover. Fasteners secure the particle shield to the structure to be protected.

Independent claim 17 is directed to a system which protects against hypervelocity particles. The system comprises means for shocking the particles and means for supporting the shocking means. The system provides a last layer of protection and also vents gas particles through opposing sides of the flexible shield. The system also consists of means for enclosing

the shocking means in a cover layer and means for securing the shocking means to the desired structure to be protected.

Independent claim 27 is directed to a hypervelocity particle shield comprising a plurality of flexible shield layers, at least one of which is made of a flexible ceramic fabric, adjacent to resilient support layers, at least one of which is a space qualified foam layer. The at least one flexible shield layer has an areal density that is substantially equal to a predetermined constant times a hypervelocity particle's cubic density multiplied by its diameter. The shield also comprises a thermal insulation layer on top of the shield layers and a back wall protector underneath the shield layers to serve as a final layer of protection. An abrasion resistant protective cover serves to enclose the flexible shield layers and has vents on a periphery thereof to facilitate venting. Fasteners are capable of releasing and securing the flexible shield layers to the structure.

### **Arguments in Support of the Claims**

Regarding the rejection of claims 16 and 17 under 35 U.S.C. 112, second paragraph, these claims have been amended to correct the indefiniteness noted by the Examiner. Accordingly, withdrawal of the rejection against these claims is respectfully requested.

Regarding the rejection of claims 1 and 17, Applicants respectfully submit *Dvorak* is not enabling for what the Examiner contends it teaches. A long standing principle in U.S. patent jurisprudence requires that a prior art reference must be enabling for what it discloses. ("No doctrine of the patent law is better established than that a prior patent or other publication to be an anticipation must bear within its four corners **adequate directions for the practice of the patent invalidated.**" *Dewey & Almy Chem. Co. v. Mimex Co.*, 124 F.2d 986, 990, 52 USPQ 138 (2d Cir. 1942) emphasis added; "Even if the claimed invention is disclosed in a printed publication, that disclosure will not suffice as prior art if it was not enabling." *Helifix Limited v. Blok-Lok, Ltd.*, 208 F.3d 1339, 1347; 54 USPQ2D 1299 (Fed. Cir. 2000) citing *In re Donohoe*, 766 F.2d at 533, 226 USPQ 619 (Fed. Cir. 1985).)

Although *Dvorak* does disclose a plurality of shield layers, it fails to disclose the relationship between the shielding materials, thickness of the layers, and distances or spacing between the layers with the particle size that can be "shocked." Nor does *Dvorak* disclose the relationship between the protection provided by the spacecraft surface itself and the protection

provided by the multi-shock shield. Without this information, Applicants respectfully submit that a person of ordinary skill in the art would not be able to determine the amount of shielding required to protect the spacecraft against a given sized particle and, therefore, would not be able to practice the claimed invention. This position is supported by the declaration under 37 C.F.R. 1.132 of Dr. Eric L. Christiansen, Ph.D., attached herewith in Appendix C.

In contrast, the present application does disclose the relationship between the shielding materials, thickness of the layers, and distances or spacing between the layers with the particle size that can be “shocked.” The application also discloses the relationship between the protection provided by the spacecraft surface itself and the multi-shock shield. These relationships are expressed, for example, in Equations 1-5 of the present application. Equations 1-2 are directed to the design of the multi-shock shield, and Equations 3-5 address the performance of the shield for a given sized particles. Note that the areal density of the shield layers,  $m_b$  ( $\text{g}/\text{cm}^2$ ), is equivalent to the product of the shield layer thickness (cm) and density ( $\text{g}/\text{cm}^3$ ) summed over all shield layers. Similarly, the areal density of the back wall,  $m_w$  ( $\text{g}/\text{cm}^2$ ), is equal to the product of back wall thickness (cm) and density ( $\text{g}/\text{cm}^3$ ). These equations allow a person of ordinary skill in the art to be able to determine the amount of shielding required to protect the spacecraft against a given sized particle. The equations were developed and verified based on a considerable amount of data from numerous hypervelocity impact tests and theoretical studies over a period of 15 years at enormous expense to the assignee of the application. For this reason, Applicants respectfully submit the equations, and the relationships embodied therein, are not known to or readily derivable by a person of ordinary skill in the art.

Furthermore, the outgassing/venting holes disclosed in *Dvorak* do not allow built up pressure within the shield to be properly released. The *Dvorak* venting holes are located on the face of the shield. However, as particles impact and penetrate the shield layers, the resulting plume of debris and gases expands outwardly in all directions, including laterally between the intact portions of the shield layers where they are trapped. As a result, a significant amount of debris and gases would not be able to escape through the *Dvorak* vent holes, which are located on the face of the shield. Thus, a person of ordinary skill in the art would not be able to practice the claimed invention based on the outgassing/venting information contained in the *Dvorak* patent.

Accordingly, for at least the reasons stated above, the *Dvorak* patent is not an enabling anticipatory reference under U.S. patent jurisprudence and, therefore, withdrawal of the rejection against claims 1 and 17 is respectfully requested.

Regarding the rejection of claim 27, Applicants respectfully submit that *Dvorak* fails to teach or suggest this claim **as amended**. Specifically, *Dvorak* fails to teach or suggest that at least one of the flexible shield layers has an areal density that is substantially equal to a predetermined constant times a hypervelocity particle's cubic density multiplied by its diameter

As for the dependent claims 2-16, 18-22, and 28-35, although they recite independently allowable subject matter, these claims depend from claims 1, 17, and 27, respectively, and are therefore allowable for at least the same reasons. Accordingly, withdrawal of the rejection against the dependent claims is respectfully requested.

New claims 36-38 are directed to a particle shield and recite, among other things, a plurality of vent holes formed in a periphery of the protective cover (claim 36), a back wall layer between the plurality of flexible shield layers and the protective cover (claim 37), and a shield layer having a thickness determined based on a size of a particle to be shocked (claim 38). Nowhere does the *Dvorak* patent teach or suggest these features. Applicants therefore respectfully request allowance of claims 36-38.

**CONCLUSION**

The rejections and objections raised by the Examiner have been addressed, and Applicants believe that the claims are now in condition for allowance, which action is respectfully requested. If any questions or issues remain and the resolution of which the Examiner feels will be advanced by a conference with the Applicants' attorney, the Examiner is invited to contact the attorney at the number noted below.

The Commissioner is hereby authorized to charge any fee which may be required, or credit any overpayment, to Deposit Account No. 10-0447, Reference No. 46782-00007USPT (DGN).

Respectfully submitted,

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